Transilvania University of Braşov, Romania

Study program: Engineering and Management of Advanced Metallic, Ceramic and Composite Materials

Faculty: Materials Science and Engineering
Study period: 2 years (master)- Year 2019-2020
Academic year structure: 2 semesters (14 weeks per semester)
Examination sessions (two): winter session (January/February)
summer session (June/July)

1st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Unconventional Technologies	SMTEHN	5	2	-	1	1

Course description (Syllabus): Getting started. The subject matter and importance of the discipline. The stage of development of unconventional technologies for materials processing abroad and in the country. Special training and design for: General presentation of Croning Processes; Realization of mouldings using easy fusible models; Realization of plaster casting forms; Process of moulding forms by Air-shock process; Special casting processes of metallic alloys; Centrifugal casting in magnetic field; Centrifugal casting of spherical cave parts; Sheet metal deformation with rubber Flexforming; Thixoforming Process; Hot isostatic processing – HIP Compaction; Dieless drawing.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Advanced Methods of Analysis and Characterization of Materials	SMTAAC	5	2	-	2	1

Course description (Syllabus): Analysis of compactness metal products. Study of phase transformation by thermal analysis (DSC, DTA). Analysis of metal and oxide materials using dilatometry. Determination of thermophysical properties: heat capacity, thermal conductivity Quantitative image analysis in materials science. Optical emission spectrometry for aalloy analysis Material characterization by X-ray diffraction Characterization of materials by scanning electron microscopy. Transmission electron microscopy. Analysis of surface micro hardness and analyze by micro and nano identification.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technologies and Equipments for Rapid Prototyping	SMTEPR	5	2	-	1	1

Course description (Syllabus): Layered manufacturing. Rapid Prototyping technologies: based on photopolymer solidification; Technologies and Equipments for Stereolithography; Rapid Prototyping technologies based on powders: 3D Printing Equipments, Selective Laser Sintering Equipments; Rapid Prototyping technologies based on material submission: Fused Deposition Modelling; Rapid Prototyping Technologies and Equipments based on sheets; Materials used in Rapid Prototyping; Rapid Tooling Technologies.

Course title	Code	No. Of Credits	Number of hours per week			
			course	seminar	laboratory	project
Technical English	SMENGT	3	-	2	-	-

Course description (Syllabus): Working in industry (a manufacturing company, products and markets, company size, company background); A tout of the workplace(arriving, location, describing the layout); Tools and equipment (workshop and facilities, the right tool for the job, in the storeroom, an unfamiliar piece of equipment); Suppliers and sub-conductor (choosing suppliers, guaranteed supply, extra staff); Building and installations (a new warehouse, the building schedule, project planning, making progress); Maintenance (a minor fault, light or heavy use ?); Troubleshooting (a personnel problem, an electrical and mechanical problem); Safety in the workplace (a noisy environment, warning signs, machine safety); Environmental matters (recycling, energy, environmentally-friendly products).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Ethics and Academic Integrity	SMEIA	2	1	-	-	1

Course description (Syllabus): *The overall objective of the discipline*- Development of the capacities of knowledge and valorisation of the main points of view regarding the academic ethics. Development of skills for identifying and solving problems with ethical implications (ethical dilemmas); Acquiring knowledge related to academic writing.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Criterial Choosing of Materials	SMAMAT	5	1	-	2	-

Course description (Syllabus): *The overall objective of the discipline*-At the end of this course the student will possess the skills to understand the correlation that exists between structure and properties, and to optimize the choice of materials so that the functional, technological, economic, ergonomic and design conditions are fulfilled. Content: Criteria for choosing materials - functional, technological, economic, ergonomic; Methods used in the optimization of the choosing of materials (functional analysis, matrix calculation, value analysis, etc.); Choosing materials for constructions of a mechanical nature, metallic nature, machine parts, chemical industry, medical industry (criteria for choosing materials, value analysis, matrix calculation, optimizing the choosing of materials).

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Equipments for Unconventional Technologies	SMETN	5	-	-	1	2

Course description (Syllabus): Getting started. The subject matter and importance of the discipline. The stage of development of unconventional processing equipment used for advanced materials worldwide and to the country. Study and design of specific equipment used for unconventional processing technologies for advanced materials such as: Specific Equipment for sheet metal deformation with rubber – Flexforming; Specific Equipment for deep drawing, thick plating, explosive plating, casting plating, etc.; Specific rolling deformation equipment.; Hydroforming - specific equipment, etc.; Specific thixoforming equipment; Isostatic compaction specific equipment; Dieless drawing specific equipment; Centrifugal equipment specific to the casting after three axes of cave parts.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Recycling of materials and environmental management	SMRMM	5	2	-	1	1

Course description (Syllabus): - National and European concepts about Recycling. Waste classification: Government Decision 856/2002 on Management Records. Specific legislation on Waste Management: Council Directive of the European Economic Community: Council Directive 75/442/EEC and 81/156/EEC; Romanian Low 211/2011 on Waste Regime. Establishing the specific operations of recycling materials. Waste Management System Components: 1. Production and Waste Collection; 2. Reuse and Recycling; 3. Waste Treatment; 4. Waste Storage. Basic concepts about Environmental Management. Specific standardization for Environmental Management: ISO 14001. Preparing documents of Environmental Management. Achieving specific Environmental Policy.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Technics for Processing of Biocompatible Materials	SMTPB	5	2	-	2	-

Course description (Syllabus): General and specific elements about the design for processing of materials in solid state. Classification of plastic deformation processes (open die forging - closed die forging, cold and hot forging, forging on hammers and presses). Processing technologies for plastic deformation – design. Plastic deformation technologies for stainless steels and titanium alloys. Processing technologies for prosthetic implants through plastic deformation – design. The effects of plastic deformation process on microstructure, residual stresses and typical internal defects. Severe plastic deformation techniques. Severe plastic deformation of titanium alloys for medical implants. Super plasticity and superplastic forming.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Synthesis of Nanomaterials and Specific Methods of Characterization (O2)	SMSNMC	5	2	-	2	

Course description (Syllabus): Nanotechnologies used in the production of nanopowders. Nanotechnologies used in production of nanofibers and nanotubes. Nanotechnologies for obtaining thin films. Production of Nanostructured Materials. Structure characterization methods for nanomaterials. Mechanical, optical and electrical characterization methods for nanomaterials. Chemical and physical characterization of nanomaterials.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Thermodynamics and Kinetics of Transformations in Solid State	SMTCTS	4	2	-	2	

Course description (Syllabus): Thermodynamic balances (applied to phase transformations in solid state) Thermodynamic potentials - free energy and free enthalpy, phase balance in single-component systems; the aspect of the equilibrium diagrams for single-component systems, the principle of Le Chatelier and Clapeyron - Clausius, the phase balance in multicomponent systems - the chemical potential - free molar enthalpy, the variation of the chemical potential with temperature and pressure, equilibrium diagrams; rules of interpretation and reading of phase diagrams, typical transformations in binary alloys, application of horizontal law and inverse segments in different alloy systems, at different concentrations. Crystalline structure of metals, kinetics of phase transformations in solid state Defects of vacancy type structure - the concept of living metal; allotropic transformation, internal activation energy and activation entropy, speed of thermally activated processes - Arrhenius equation, fraction transformed and defining the global speed of transf. in solid state, the evolution equations of phase transformations in solid state, experimental methods of measuring the global velocity of transformation in solid state, experimental determination of activation energy.

2nd Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Expert Software CAD/CAM/CAE	SMSEXP	5	2	-	1	1

Course description (Syllabus): Expert software for technological processes management; Unconventional casting process simulation; Expert software for mould design; Experimental systems simulation assisted by computer; Designing experimental systems of measurement, adjustment and control using LabVIEW software. Design application using CATIA;

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Modelling, Simulation and Optimization of Processes	SMMSOP	5	1	-	2	-

Course description (Syllabus): General information's about modelling and optimization of processes. Physical and chemical analysis of processes. Mathematical modelling of processes. Methods to solve mathematical equations. Software for simulation of processes. Principles of modeling heat exchange at solidification of casting alloys. Study of alloy solidification by computer simulation. Optimization of cast design technology by mathematical modelling and computer simulation.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Total Quality Management	SMMCT	5	1	2	-	-

Course description (Syllabus): The concept of Total Quality Management (TQM). TQM principles. Standardization. Vocabulary and terminology in quality. ISO 9000. The Primary Elements of TQM. Implementing Total Quality Management. How Total Quality Management Began. Deming's 14 Points & TQM. Why should a company adopt TQM?

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
European Programmes and Strategies in Materials Science Field	SMPESD	3	1	-	-	1

Course description (Syllabus):EU organization and Romanian position; Categories of European Programs; Research programs – COST, FP7, EUREKA; Mobility programs – Marie Curie; Principles of drawing up of one proposal; Peculiarities of materials science programmes; Quality of the research team; Basic financial aspects.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Engineering of Thin Films	SMISS	5	2	-	1	1

Course description (Syllabus): - Surface engineering; fundamentals. General aspects of plasmas used in deposition technologies. Evaporation and sputter deposition. Plasma - assisted physical vapour deposition . Plasma - assisted chemical vapour deposition. Thermal spraying. Ion implantation and ion - assisted coatings. Characterization of coatings and interfaces.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Tribological Characterisation of Surfaces	SMCTRS	5	1	-	2	1

Course description (Syllabus): - Surface engineering; fundamentals. Introductory notions on surface engineering and surface topography. Mechanical elements of the contacts: types of wear, contact areas. Notions about rubbing and wear: tribology at micro and nanometric level; lubricants; Methods for determining the surface roughness. Methods for determining the friction coefficients. Methods for determining the speed of use of surfaces. Improvement of tribological properties of surfaces by depositing thin layers.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Logistics and Management of Materials	SMLOMMM	4	1	-	2	-

Course description (Syllabus): Materials management planning and design; Materials management challenges; Supply chain materials management; Improving circulation infrastructure; Day-to-day movement of raw materials and resources; Purchasing and shipping; Inventory control and quality control.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Total Productive Maintenance	SMMETP	3	1	-	2	-

Course description (Syllabus): - Modern techniques to develop creative behaviour (Kano model, Doblin's 10 innovation types); Creative behaviour inventory; Enhancing communication between industry and educational providers; Entrepreneurship thinking and behaving; Specificities in patent application forms; Intellectual property – beyond current practice.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practical Activity and/or Scientific Research	SMPRED	5	14 weeks x 6 hours/week = 84 hours			

Course description (Syllabus): Experimental development in scientific research projects conducted in the Department. MA students will work in mixed teams with PhD and coordinators research grants. The topics considered are: Innovative technologies for synthesis and processing of materials. Development of innovative materials Technologies for materials synthesis and processing and environmental impact analysis.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practical Activity	SMPRC1-4	32	56 weeks x 8 hours/week = 448 hours			

Course description (Syllabus): In each semester there are given to make specific practical activities: 8 hours/week x 14 weeks = 112 hours. The topics considered are: Innovative technologies for synthesis and processing of materials. Development of innovative materials Technologies for materials synthesis and processing and environmental impact analysis. - themes with specific research activity related to each personal final dissertation work

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Drafting of dissertation work	SMELPD	10	4 weeks x 16 hours/week = 64 hours			

Course description (Syllabus): The current stage of the topic approached, choosing the best technology, theoretical design aspects. Choosing the necessary equipment and redesigning the main elements. Experimental results of the chosen technology and interpretation of the results. Economic aspects, management elements and environmental protection related to the chosen topic.